



## PATENT ABSTRACTS OF JAPAN

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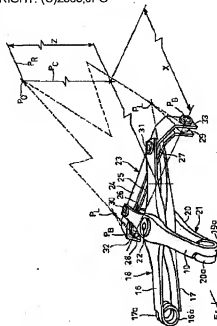
**B60G 7/00****B60G 9/04****B60G 21/05**(21) Application number: **2002074855**(71) Applicant: **HORIKIRI:KK**(22) Date of filing: **18.03.02**(72) Inventor: **MOMIYAMA FUJIO**(54) **SUSPENSION LINK**

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(57) Abstract:

**PROBLEM TO BE SOLVED:** To reduce manufacturing cost and to largely decrease entire weight while securing a excellent function that is not inferior to a conventional X-link.

**SOLUTION:** Leaf spring pieces 16 and 17 are vertically overlapped in a facing state to constitute a first I-type piece 18. Leaf spring pieces 19 and 20 are vertically overlapped in a facing state on both sides of the first I-type piece 18 to constitute a second I-type piece 21. The longitudinal central parts of them are crossed each other and connected tiltably via a pin 22. A connecting bar 23 is bridged between respective ends of the I-type pieces 18 and 21, and bending parts 32 and 33 formed to fold downwardly are connected to both ends of the connecting bar 23 oscillatably with the axle, respective other ends of the I-type pieces 18 and 21 are connected to the frame before the axle oscillatably with the frame, and the rolling center PO of the car body is disposed over the connecting bar 23 and under the vehicle center of gravity.



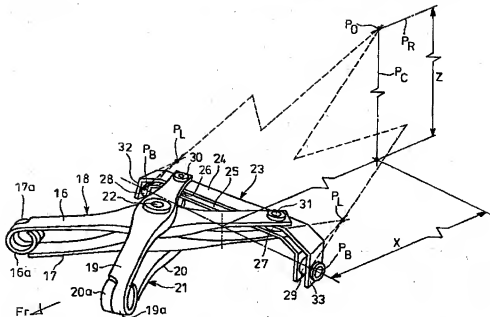
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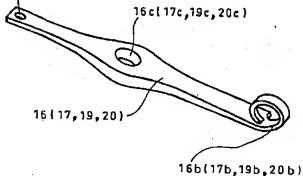
DRAWINGS

[Drawing 1]

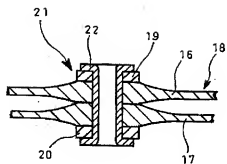


[Drawing 2]

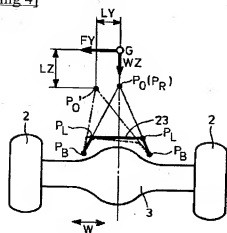
16a (17a, 19a, 20a)



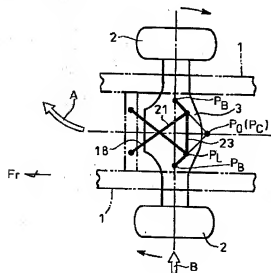
[Drawing 3]



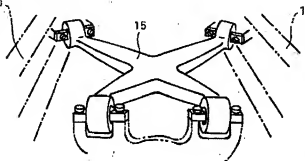
[Drawing 4]



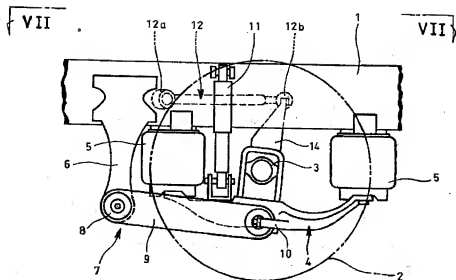
[Drawing 5]



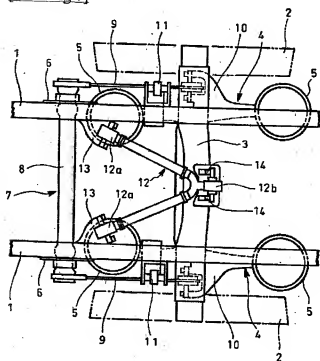
[Drawing 8]



[Drawing 6]



[Drawing 7]



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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a suspension link.

[0002]

[Description of the Prior Art] Drawing 6 and drawing 7 are what shows an example of the rear-suspension structure in large-sized cars, such as a truck and a bus. The frame 1 of a Uichi Hidari pair prolonged in the cross direction (longitudinal direction in drawing 6) of a car body caudad The axle 3 for extending in the cross direction (the vertical direction in drawing 7), and supporting a wheel 2 to revolve with the both ends is arranged. Between the support-beam 4 order edge attached to the inferior surface of tongue of the edge approach of this axle 3 in one, and said frame 1 inferior surface of tongue, the air spring 5 which absorbs vibration of the vertical direction is infixed.

[0003] Moreover, the bracket 6 of the air spring 5 arranged at the before side prolonged in the lower part sense is further attached in the front frame 1, and between the lower limit section of this bracket 6 and the pars intermedia of said support beam 4 is connected free [ tilting ] by the stabilizer 7 which raises the roll rigidity of a car body.

[0004] Namely, the stabilizer 7 currently illustrated here The stabilizer bar 8 which consists of the pipe (hollow shaft) of the hollow which is generally called the Roa Rod integral stabilizer and was constructed free [ rotation ] between the lower limit sections of the bracket 6 on either side. It is constituted by the arm 9 connected through the rubber bush to the bracket 10 which fixed and equipped the both ends of this stabilizer bar 8 with the end, and prepared the other end in the pars intermedia of said support beam 4, and pons delivery of between the wheels 2 on either side is carried out to the character type of KO. Although the stabilizer bar 8 rotates to a bracket 6 and especially the stabilizer 7 does not work when the wheel 2 on either side moves up and down to coincidence When the vertical movement from which the wheel 2 on either side differs by a cornering etc. is accomplished, it is twisted to the stabilizer bar 8 and the moment acts, and work which returns the wheel 2 on either side by the reaction force is accomplished.

[0005] the variation rate to the angular moment (damping force and driving force) and the longitudinal direction of the circumference of the shaft applied to an axle 3 only with these arms 9 although it enables it to be managed even if the arm 9 in this stabilizer 7 also has the function to perform the location of an axle 3, and an include-angle arrangement as a torque rod by the side of Roa here and it does not independently prepare the torque rod by the side of Roa -- it is difficult to certainly hold down the moment.

[0006] For this reason, between the center-section top face of an axle 3 and the medial surfaces of the frame 1 on either side It is connected with the V rod 12 which functions as a torque rod by the side of an upper. More specifically Branching edge 12a (front side edge section) which separated to right and left of this V rod 12 is connected through a rubber bush to the bracket 13 extended from the medial surface of the frame 1 on either side. Moreover, crookedness edge 12b (back side edge section) of V rod 12 center is connected through the rubber bush to the bracket 14 prepared in the center-section bottom of an axle 3.

[0007] And if such a V rod 12 is adopted, since it will become possible to correspond to the input of the sense of both the cross direction of a car body, and a longitudinal direction Since it can be managed even if it does not install separately the lateral rod as a cure against an input of a

longitudinal direction like [ at the time of adopting the torque rod of an parallel link type ], and offset arrangement is moreover carried out to the lower arm 9 in the upper part It becomes possible to certainly hold down the angular moment of the circumference of the shaft concerning an axle 3.

[0008] In addition, it is connected by the shock absorber 11 prolonged in the vertical direction, and \*\*\*\* return of vibration of the vertical direction is controlled by this shock absorber 11, and it is made to be planned in periodic damping between the halfway section of said support beam 4, and the frame 1 of the right above of it.

[0009] on the other hand, as a new suspension link replaced with the V rod 12 mentioned above in recent years \*\*\*\* shown in drawing 8 -- the really fabricated X link 15 being proposed so that an overall flat-surface configuration may accomplish an X type, and according to the X link 15 of such a flat-surface configuration On [ which can be corresponded to the input of the sense of both the cross direction of a car body, and a longitudinal direction like the case of the conventional V rod 12 ], Since work of a stabilizer which it is twisted when the vertical movement from which the wheel 2 (refer to drawing 6 and drawing 7 ) on either side differs by a cornering etc. is accomplished, and the moment acts, and returns the wheel 2 on either side by the reaction force is accomplished It becomes possible to transpose to the torque rod of a simple parallel link type, using the stabilizer 7 of the Roa Rod integral as shown in drawing 6 or drawing 7 as unnecessary.

[0010]

[Problem(s) to be Solved by the Invention] However, in the former, since he was trying to really by, forging manufacture the X link 15 as mold goods, there was a problem that a manufacturing cost will work cheaply, moreover whole weight became big, it attached, and there was a problem that the workability at the time worsened.

[0011] This invention is what was made in view of the above-mentioned actual condition, and it aims at offering the new suspension link which enabled it to attain large lightweight-ization of reduction of the manufacturing cost, and whole weight, securing the outstanding function which is not inferior to the conventional X link.

[0012]

[Means for Solving the Problem] While constituting the first I-beam piece from a condition facing each other in piles up and down, this invention the first flat spring piece and the second flat spring piece On both sides of the I-beam piece of this first, the second I-beam piece is constituted for the third flat spring piece and the fourth flat spring piece from a condition facing each other in piles up and down in between. Arrange the these firsts and second each of I-beam piece so that mutual longitudinal direction center sections may cross, and a part for the intersection is connected free [ tilting ] by the pin penetrated in the vertical direction. The connector bar which extends horizontally first and second between [ of I-beam piece / each ] the end sections is constructed. Form in the both ends of this connector bar the ups-and-downs section which bends to the lower part sense, and connect this each ups-and-downs section free [ rocking ] to an axle, and said connector bar is made to extend in the cross direction right above [ of said axle ]. On the other hand, each first and second other end of I-beam piece is connected free [ rocking ] to the frame which serves as the car front from said axle. The rolling core of the car body decided by the bending configuration of each ups-and-downs section of said connector bar starts the suspension link which is the upper part and is characterized by constituting so that it may be caudad arranged rather than a car center of gravity rather than said connector bar.

[0013] If it \*\* and does in this way, since it will become possible to constitute the suspension link of an X type only from attaching the first [ which can be cheaply manufactured using the production process of the usual flat spring ] thru/or fourth flat spring piece, it becomes possible to reduce a manufacturing cost sharply as compared with the case where the one cast of an X type is manufactured with forging.

[0014] Moreover, if the first and second height dimensions of I-beam piece are set up so that it may become large a little from the height dimension of the cross-section form of each arm part of the conventional X link Even if between the flat spring piece of the upper and lower sides serves as an opening and total of the mutual cross section is smaller than the cross section of each arm part of the conventional X link It becomes possible, since a big difference is not produced in a substantial second moment of area (numeric value showing the geometric difficulty of a beam cross section of

bending to the bending moment) to lightweight-size whole weight sharply, without really by forging causing a fall on the strength as compared with X link of a cast.

[0015] When it is that in which the first thru/ or fourth flat spring piece has high toughness especially as compared with the usual plate, It is devised so that a part for the first and second intersection of I-beam piece may be connected free [ tilting ] and shearing stress may not act. It has structure with few burdens which will end if each flat spring piece corresponds only to simple bending stress by this. And since rational arrangement which another side pulls and deforms is adopted when it is in the condition facing each other for every I mold piece and either of up-and-down carries out a compression set, it becomes possible to attain very rational lightweight-ization under the conditions which secure a function equivalent to the conventional X link.

[0016] And each end section side of I mold each piece is connected with an axle free [ rocking ] through the connector bar. Since the rolling core of a car body is the upper part and it is made to be caudad arranged from the connector bar rather than the car center-of-gravity location in it with the bending configuration of each ups-and-downs section in the both ends of this connector bar The location based on [ used as the radix point of rolling of a car body ] rolling becomes higher than before, a mutual distance with a car center of gravity becomes short, an anti rolling moment will act at the time of rolling, and generating of a rolling moment will be controlled remarkably.

[0017] And if generating of a rolling moment is controlled remarkably in this way, in order to achieve the function as a stabilizer at the time of a cornering, since it will be twisted and the moment will be mitigated sharply, the thing to which I mold each piece should pay and for which small [ of I mold each piece / further ] and lightweight-ization are realized will become possible.

[0018] Moreover, if it is desirable to constitute so that the compliance steer core decided by the bending configuration of each ups-and-downs section of the connector bar may be arranged from an axle in this invention in car back and it does in this way When reaction force acts on the reverse sense in the touch-down section of a road surface side empty vehicle ring to a centrifugal force at the time of a cornering It will appear with the understeer inclination for a compliance steer to turn to a revolution side to a car core by top surface view, and a rollover steer will be negated by the compliance steer of this understeer inclination.

[0019] Namely, the existing suspension generally used If there is much what set up the locus of an axle with some backward tilting, a centrifugal force acts towards an anti-revolution side at the time of a cornering and rolling arises from a viewpoint which improves riding comfortability by relaxation of a road surface impact input even if it adopts which format A car body's revolution side comes floating to an axle, and an anti-revolution side sinks. While it is the revolution side to which a car body comes floating, and an axle descends relatively and displaces a backward-tilting orbit top ahead In the anti-revolution side whose car body is depressed, an axle goes up relatively and displaces a backward-tilting orbit top back. It inclines so that the whole axle may turn to an anti-revolution side to a car core by top surface view, and an axle steer arises, and it is in the inclination which is easy to cause a rollover steer which decreases the TR to the guide direction which this determined by the front-side.

[0020] Then, if the rollover steer which has been a common technical problem about such an existing suspension can be controlled by setting up the compliance steer of an understeer inclination, it will become possible to contribute to improvement in the driving stability at the time of a cornering greatly.

[0021]

[Embodiment of the Invention] The gestalt of operation of this invention is explained below, referring to a drawing.

[0022] Drawing 1 - drawing 5 are set to the suspension link of this example of a gestalt, as an example of a gestalt which carries out this invention is shown and it is shown in drawing 1. While constituting the first I-beam piece 18 from a condition facing each other in piles up and down, the first flat spring piece 16 and the second flat spring piece 17 On both sides of the I-beam piece 18 of this first, the second I-beam piece 21 is constituted for the third flat spring piece 19 and the fourth flat spring piece 20 from a condition facing each other in piles up and down in between. Arrange the these firsts and second each of the I-beam piece 18 and 21 so that mutual longitudinal direction center sections may cross, and a part for the intersection is connected free [ tilting ] by the pin 22

penetrated in the vertical direction. It has structure which constructed the connector bar 23 which extends horizontally first and second between [ of the I-beam piece 18 and 21 / each ] the end sections.

[0023] The connector bar 23 shown in drawing 1 has structure which connected the division bars 24 and 25 of two upper and lower sides which see from car back and accomplished the inverted-U character mold through the four boss sections 26, 27, 28, and 29 here. It arranges so that the end section of the I mold each piece 18 and 21 may be put from the upper and lower sides to the boss sections 26 and 27 arranged to the both ends of the Naonobu section of said I mold each piece 18 and 21. It has connected mutual by crushing a vertical edge through the tubular rivet which accomplishes pins 30 and 31 to the through tubes 16a, 17a, 19a, and 20a (refer to drawing 2) drilled in this one edge each, and said boss sections 26 and 27, enabling free tilting.

[0024] On the other hand, the first thru/or fourth flat spring piece 16, 17, 19, and 20 It is formed so that the same configuration may be accomplished in \*\*\*\*\* which all show to drawing 2. Bring near by one side of the cross direction, and Eyes 16b, 17b, 19b, and 20b are formed in the longitudinal direction other end of each flat spring piece 16, 17, 19, and 20. When it piles up and down in the condition facing each other with each combination partner, it is constituted so that the boss section may be accomplished together with the cross direction, without mutual eye 16b, eye 17b and eye 19b, and eye 20b interfering.

[0025] Moreover, the through tubes 16c, 17c, 19c, and 20c for making a pin 22 penetrate free [ sliding ] are drilled in the longitudinal direction center section of each flat spring piece 16, 17, 19, and 20, and as shown in drawing 3, each flat spring piece 16, 17, 19, and 20 of both is connected by crushing a vertical edge through the tubular rivet which accomplishes a pin 22 in the condition of having made these agreeing, enabling free tilting.

[0026] And the suspension link constituted in this way So that it may bend to the lower part sense outside said each boss sections 26 and 27 of the connector bar 23 Connect the ups-and-downs sections 32 and 33 of the formed right and left free [ rocking ] through a bracket etc. to an axle 3 (refer to drawing 4 and drawing 5), and said connector bar 23 is made to extend in the cross direction right above [ of said axle 3 ]. On the other hand, each first and second other end of the I-beam piece 18 and 21 is connected free [ rocking ] through a bracket etc. to the frame 1 (refer to drawing 5) which serves as the car front from said axle 3.

[0027] If it states more concretely, the connection to the axle 3 of each ups-and-downs sections 32 and 33 which can be rocked Fit-in wearing of the rocking pin which is not illustrated through a rubber bush to the boss sections 28 and 29 by which penetration wearing was carried out in said each ups-and-downs sections 32 and 33 is carried out. It is carried out by attaching this each rocking pin through a bracket to an axle 3 top. Moreover, the connection to the first and second frames 1 of the other end of the I-beam piece 18 and 21 which can be rocked Fit-in wearing of the rocking pin which is not illustrated through a rubber bush to the boss section which Eyes 16b and 17b and Eyes 19b and 20b accomplish is carried out, and it has been made to be carried out by attaching this each rocking pin through a bracket to the frame 1 on either side.

[0028] Furthermore, the bending configuration of each ups-and-downs sections 32 and 33 of the connector bar 23 It is formed in the second page chip box of \*\*\*\* shown in drawing 1, and the intersection when extending the ridgeline of this second page chip box to car back has accomplished the link supporting point PL of imagination. Link actuation as if the end section of the I mold each piece 18 and 21 is prolonged to the link supporting point PL of imagination and the between from this link supporting point PL to the bush core PB of the boss sections 28 and 29 of each ups-and-downs sections 32 and 33 was tied by another link rod is performed.

[0029] And the intersection PO when turning to car back the line which connects the link supporting point PL and the bush core PB of imagination on either side, and extending it It is arranged in the location where only X retreated to connection location empty vehicle both the back to the axle 3 of each ups-and-downs sections 32 and 33, and only Z went up upwards from the connection level to the axle 3 of each of said ups-and-downs sections 32 and 33. It is decided that the rolling core PR of a car body will be the location which passes along this intersection PO in a car cross direction. It is decided that the compliance steer core PC of a car body will be the location which passes along Intersection PO in the vertical direction, and it sets for this example of a gestalt. As are shown in



drawing 4, and the rolling core PR is the upper part from said connector bar 23, and is caudad arranged from the car center of gravity G and moreover shows drawing 5, the compliance steer core PC is arranged from an axle 3 in car back.

[0030] Supplement, and if it explains, in addition, the rolling core at the time of adopting the conventional X link It becomes the height location which passes along a part for the intersection of the X configuration in a car cross direction. In the case of V rod It becomes the height location which passes along the crookedness edge (back side edge section) of the center of the V configuration in a car cross direction, and usually the rolling core is arranged in the comparatively low height location near [ in any case ] the connection level to an axle 3.

[0031] If it \*\* and a suspension link is constituted in this way, since it will become possible to constitute the suspension link of an X type only from attaching the first [ which can be cheaply manufactured using the production process of the usual flat spring ] thru/or fourth flat spring piece 16, 17, 19, and 20, as compared with the case where the one cast of an X type is manufactured with forging, a manufacturing cost will be reduced sharply.

[0032] Moreover, if the first and second height dimensions of the I-beam piece 18 and 21 are set up so that it may become large a little from the height dimension of the cross-section form of each arm part of the conventional X link Even if the flat spring piece 16 and 17 of the upper and lower sides and between 19 and 20 serve as an opening and total of the mutual cross section is smaller than the cross section of each arm part of the conventional X link It becomes possible, since a big difference is not produced in a substantial second moment of area (numeric value showing the geometric difficulty of a beam cross section of bending to the bending moment) to lightweight-ize whole weight sharply, without really by forging causing a fall on the strength as compared with X link of a cast.

[0033] Especially the first thru/or fourth flat spring piece 16, 17, 19, and 20 When it is what has high toughness as compared with the usual plate, it is devised so that a part for the first and second intersection of the I-beam piece 18 and 21 may be connected free [ tilting ] by the pin 22 and shearing stress may not act. It has structure with few burdens which will end if each flat spring piece 16, 17, 19, and 20 corresponds only to simple bending stress by this. And since rational arrangement which another side pulls and deforms is adopted when it is in the condition facing each other for every I mold piece and either of up-and-down carries out a compression set, it becomes possible to attain very rational lightweight-ization under the conditions which secure a function equivalent to the conventional X link.

[0034] And each end section side of the I mold each piece 18 and 21 is connected with an axle 3 free [ rocking ] through the connector bar 23. Since the rolling core PO of a car body is the upper part and it is made to be caudad arranged from the connector bar 23 from the car center of gravity G in it with the bending configuration of each ups-and-downs sections 32 and 33 in the both ends of this connector bar 23 The location based on [ used as the radix point of rolling of a car body / PO ] rolling becomes higher than before, a mutual distance with the car center of gravity G becomes short, an anti rolling moment will act at the time of rolling, and generating of a rolling moment will be controlled remarkably.

[0035] That is, for this centrifugal force FY, when the height dimension to the car center of gravity G located from the rolling core PO in that upper part since it will act on an anti-revolution side to the car center of gravity G, if the centrifugal force which acts towards an anti-revolution side at the time of a coming is set to FY as shown in drawing 4 is set to LZ, the rolling moment MO which makes a car body roll is the following formula [several 1]. It is expressed with  $MO=LZ \times FY$ .

[0036] Moreover, if a centrifugal force FY acts on the car center of gravity G, since it will move to the location of PO' which deforms the connector bar 23 into the location shown in an imaginary line from the continuous-line location of drawing 4, and also shows the rolling core PO by the imaginary line in drawing 4, when weight by the side of the car body which acts on the car center of gravity G is set to WZ and the amount of gaps based on [ PO ] rolling is set to LY, the anti rolling moment MA is the following formula [several 2]. It is expressed with  $MA=LY \times WZ$ .

[0037] Therefore, the actual rolling moment M which acts on a car body at the time of revolution of a car is the following formula [several 3]. It is expressed with  $M=MO-MA=LZ \times FY-LY \times WZ$ , consequently a rolling moment M becomes small, and the anti rolling effectiveness can be given to a

car-body side.

[0038] And if generating of a rolling moment is controlled remarkably in this way, in order to achieve the function as a stabilizer at the time of a cornering, since it will be twisted and the moment will be mitigated sharply, the thing to which the I mold each piece 18 and 21 should pay and for which small [ of the I mold each piece 18 and 21 / further ] and lightweight-ization are realized will become possible.

[0039] Therefore, since according to the above-mentioned example of a gestalt the first thru/or fourth flat spring piece 16, 17, 19, and 20 can be attached and the suspension link of the X type which has the outstanding function which is not inferior to the conventional X link can be manufactured cheaply, the manufacturing cost can be reduced remarkably and, moreover, large lightweight-ization of whole weight can be attained.

[0040] Moreover, since it constitutes so that the compliance steer core PC decided by the bending configuration of each ups-and-downs sections 32 and 33 of the connector bar 23 may be arranged from an axle 3 in this example of a gestalt in car back For example, as shown in drawing 5 , in case a car circles rightward which is shown by the arrow head A Even if it inclines so that the axle 3 whole may turn to a revolution side to a car core by top surface view, and an axle steer arises and a roll undershirt steer which increases the TR to the guide direction which this determined by the front-side newly arises As an arrow head B shows, when reaction force acts on a centrifugal force and the reverse sense at the touch-down section of the road surface side empty vehicle ring 2 It will appear with the understeer inclination for a compliance steer to turn to a revolution side to a car core by top surface view, and a rollover steer will be negated by the compliance steer of this understeer inclination.

[0041] Namely, the existing suspension generally used If there is much what set up the locus of an axle 3 with some backward tilting, a centrifugal force acts towards an anti-revolution side at the time of a cornering and rolling arises from a viewpoint which improves riding comfortability by relaxation of a road surface impact input even if it adopts which format A car body's revolution side comes floating to an axle 3, and an anti-revolution side sinks. While it is the revolution side to which a car body comes floating, and an axle 3 descends relatively and displaces a backward-tilting orbit top ahead In the anti-revolution side whose car body is depressed, an axle 3 goes up relatively and displaces a backward-tilting orbit top back. It inclines so that the axle 3 whole may turn to an anti-revolution side to a car core by top surface view, and an axle steer arises, and it is in the inclination which is easy to cause a rollover steer which decreases the TR to the guide direction which this determined by the front-side.

[0042] Then, if the rollover steer which has been a common technical problem about such an existing suspension can be controlled by setting up the compliance steer of an understeer inclination, it can contribute to improvement in the driving stability at the time of a cornering greatly.

[0043] In addition, as for the suspension link of this invention, it is needless to say that modification can be variously added within limits which do not deviate from that it is not limited only to the above-mentioned example of a gestalt, and can apply to the suspension structure of various formats and the other summaries of this invention.

[0044]

[Effect of the Invention] According to the suspension link of above-mentioned this invention, the effectiveness which was excellent in the versatility like the following can be done so.

[0045] (I) Securing the outstanding function which is not inferior to the conventional X link according to invention of this invention according to claim 1, the manufacturing cost can be reduced remarkably and, moreover, large lightweight-ization of whole weight can be attained.

[0046] (II) Since according to invention of this invention according to claim 2 a rollover steer can be controlled as the compliance steer at the time of a cornering is appeared with an understeer inclination, improvement in the driving stability at the time of a cornering can be aimed at.